IMPROVEMENTS IN OR RELATING TO WALL SYSTEMS

This invention concerns improvements in or relating to wall systems. The invention has particular, but not exclusive, application to a modular wall system for constructing temporary buildings such as may be erected for warehousing and dismantled when not required for re-use on the same or different site.

A wall system is already known that employs elongate panels arranged to extend horizontally between a pair of upright support members to form a wall. The support members are typically provided with longitudinal channels to receive the ends of the panels and the panels are stacked one on top of another to form a wall of the desired height.

In the known system, the panels comprise a core of rigid foam such as polyurethane with a thin outer skin of sheet metal such as aluminium. The panels are provided with longitudinally extending tongue and groove formations on opposite edges so that adjacent edges of adjoining panels interlock when the panels are stacked on top of each other between the support members to form the wall.

A disadvantage of the known system is that the panels are susceptible to damage. For example, the outer metal skin may be deformed or ruptured if the panel is struck by an object. This is a particular problem for warehousing where heavy items may be moved about and stacked on top of each other with a high risk of contact with the wall.

A damaged panel cannot be easily replaced without extensive dismantling of the wall which may not be possible where the access to remove the

panels is hindered by the roof. Furthermore, damaged panels cannot be re-used when the building is dismantled.

Another disadvantage of the known system is that the panels can be deformed by high wind loads normal to the length of the panels. This restricts the length of the panels that can be employed without increasing significantly the thickness of the outer skin which is undesirable from both cost and weight consideration.

Yet another disadvantage of the known system is that the panels cannot be easily adapted to incorporate glazing in the wall. Moreover, the panels cannot readily support brackets as may be required for shelving for storage or other purposes.

The present invention has been made from a consideration of the foregoing problems and disadvantages of the known wall systems.

Thus, the present invention seeks to provide a wall system in which some or all of these problems and disadvantages are overcome or mitigated.

According to a first aspect of the present invention, there is provided a wall system comprising a plurality of elongate panel members arranged to extend horizontally between a pair of upright support members wherein the panel members are stacked one on top of another in a vertical plane to form a wall of the desired height wherein the panel members are formed with at least one internal longitudinal chamber, wherein at least some of the panel members are provided with an elongate reinforcing member extending lengthwise of the chamber, and wherein the reinforcing members are constructed and arranged to have a higher resistance to

forces applied in a direction normal to the vertical plane of the wall than parallel to the vertical plane of the wall.

Preferably each reinforcing member comprises a plurality of generally parallel plates connected by webs whereby the reinforcing member is of increased strength in the plane of the plates than at right angles thereto. In this way the strength of the reinforcing member in mutually perpendicular directions transverse to the length are different.

This differential strength can be employed to advantage in the present invention to strengthen the wall against wind loads by arranging the reinforcing members so that the plates extend generally parallel to the direction of the wind loads.

In a preferred construction, each reinforcing member is of approximately W-section and can be made by rolling from sheet metal. It will be understood however that other sections may be usefully employed in this invention.

Preferably, the panel members are made of plastics material, for example by extrusion. In one arrangement, the panel members are of generally hollow rectangular section with spaced parallel side walls and longitudinally extending edge formations that co-operate to locate adjacent panel members relative to each other on assembly of the wall. For example, each panel member may be provided with mating tongue and groove formations on the opposed edges.

Advantageously, the panel members are divided internally into a plurality of chambers by one or more partition walls extending between the side walls that help to strengthen the panel member. In a preferred

arrangement, panel members are provided with a longitudinal slot in at least one side wall that can be used to attach a member to the wall. For example, the slot may locate and retain a bracket to support shelving for storage on the inner face of the wall. Alternatively, the bracket may support guttering for drainage on the other face of the wall.

Some embodiments of the invention may incorporate glazing in the wall to allow natural light to enter the building. The glazing may be located by glazing members arranged to extend above and below a glazing panel with the glazing members adapted to co-operate with the edge formations of the adjacent panel members. In a preferred arrangement, the glazing members are obtained by cutting one of the panel members to remove a centre section for the glazing panel.

Advantageously, the support members are adapted to allow the wall to be constructed by inserting the panel members one-by-one between the support members at the lower end and raising the panel members to allow the next panel member to be inserted until the desired height of the wall is achieved. The wall can be dismantled when it is desired to take the building down by a reverse of this procedure. In this way, the wall can be erected and dismantled without requiring access to the upper end of the support members and therefore without interference where the support members are connected to the roof.

According to another aspect of the present invention there is provided in or for a panel member for constructing a modular wall a reinforcing member of approximately W-section.

The W-section provides a stack of four substantially parallel plates connected to one another by webs such that the reinforcing member is

stronger in a direction parallel to the plates than in a direction normal to the plates.

These and other features, benefits and advantages of the invention will be more fully understood from the description of exemplary embodiments hereinafter.

The invention will now be described in more detail with reference to the accompanying drawings wherein:

Figure 1 is a side view of a wall system according to the present invention;

Figure 2 is a perspective view, to an enlarged scale, from one end of a wall panel member shown in Figure 1;

Figure 3 is a perspective view from one end of a reinforcement member for the wall panel member shown in Figure 2;

Figure 4 shows a detail of a vertical support member shown in Figure 1;

Figure 5 shows a modification of the wall system shown in Figure 1 to accommodate glazing;

Figure 6 is a section, to an enlarged scale, on the line 6-6 of Figure 5; and

Figure 7 shows a modification of the glazing system shown in Figure 5.

Referring first to Figures 1 to 4 of the drawings, a wall system 1 for use in constructing a section of a wall for a building such as a temporary warehouse is shown. The system 1 comprises a plurality of elongate panel members 2 arranged to extend horizontally between a pair of upright support members 3, 4.

As will be appreciated, the building may be rectangular shape in plan view with four walls supporting a roof. Each wall may comprise one or more sections according to the required size of the building. Other shapes of building are also possible with the modular wall system of this invention.

The panel members 2 are stacked one on top of another to form a wall of the desired height and the ends of the panel members 2 are received and retained in vertical channels 3a, 4a extending lengthwise of the support members 3, 4. For example, the support members 3,4 may comprise metal posts of H-section to provide two channels for connecting adjoining wall sections.

As best shown in Figure 2, each panel member 2 is of generally rectangular section with spaced, parallel side walls 5, 6. Each panel member 2 is provided with mating tongue and groove formations 7, 8 extending lengthwise of the panel member 2 along the opposed edges between the side walls 5, 6.

In this embodiment, the tongue 7 is of trapezium shape in transverse section and the groove 8 is of matching shape. In this way, the tongue 7 of one panel member 2 is received in the groove 8 of an adjoining panel member 2 when the panel members 2 are stacked on top of each other to locate and retain the panel members 2 relative to each other.

The trapezium shape of the tongue 7 with relatively convergent side faces 7a, 7b provides a fluid-tight seal with the opposite side faces 8a, 8b of the mating groove 8 which are relatively convergent at the same angle.

In this embodiment, the side faces 7a, 7b and 8a, 8b are symmetric with respect to the vertical plane of the wall. In this way, the panel members 2 can be assembled one on top of the other with either of the side walls 5, 6 forming the external surface of the wall and the other side wall forming the internal surface of the wall. It will be understood that this is not essential and the formations may be non-symmetric so that the panel members 2 can be assembled in one orientation only.

The panel members 2 are divided internally into a plurality of rectangular chambers 9, 10, 11, 12 and 13 by partition walls 14, 15, 16 and 17 extending between the side walls 5, 6. The chambers 9, 10, 11, 12 and 13 extend lengthwise of the panel members 2 and allow air to circulate between the side walls 5, 6 within the panel members 2.

One of the chambers 10 is divided into two sub-chambers 10a, 10b by an internal partition wall 18 extending between the partition walls 14, 15. The partition wall 18 is parallel to the side walls 5, 6 and is offset towards the side wall 6 so that the chamber 10a is smaller than the chamber 10b.

The side wall 6 is formed with a longitudinal slot 19 that opens to the chamber 10a such that a bracket (not shown) of T-shape may be located with its head section in the chamber 10a and a body section protruding from the chamber 10a through the slot 19.

The panel members 2 can be assembled with the slot 19 on the internal surface of the wall and the brackets employed to support shelving for storage or any other purpose as desired. Alternatively, at least one panel member 2 can be reversed with the slot 19 on the external surface of the wall and the brackets employed to support guttering for drainage or any other purpose as desired.

In one arrangement, each bracket is inserted from one end of the panel member 2 prior to assembly. This allows the brackets to be slid lengthwise of the panel member 2 to the desired position after assembly. In another arrangement, the head section can be inserted through the slot 19 and the bracket rotated to locate and retain the head section within the chamber 10a at the desired position. This permits the brackets to be fitted and removed after assembly of the wall as required.

The panel members 2 are made of plastics material such as polyurethane by extrusion of standard lengths from which panel members 2 of any desired length can be parted. Generally, the panel members 2 are up to 5 metres in length and at least some of the panel members 2 are provided with a reinforcing member 20 received in one of the chambers 9, 10, 11, 12, 13.

Typically the reinforcing member 20 is received in either the chamber 9 adjacent the groove 8 or the chamber 13 adjacent the tongue 7. In this way, the reinforcing member 20 provides localised reinforcement for the joint between adjacent panel members 2.

As best shown in Figure 3, the reinforcing member 20 is of approximately W-section with four plates 20a, b, c, d connected on opposite sides by

flat or square webs 20e, f, g. The member 20 is made of metal, typically steel, for example by rolling.

The W-section gives the reinforcing member 20 a higher resistance to forces applied in a direction parallel to the plates as shown by arrow A in Figure 3 than in a direction at right angles to the plates as shown by arrow B in Figure 3.

In use, the reinforcing member 20 is inserted in the chamber 9 or 13 so that the plates 20a, b, c, d extend between the side walls 5, 6 of the panel member 2. The dimensions of the reinforcing member 20 are such that the webs 20 e, f, g seat against the internal surfaces of the side walls 5, 6 within the chamber 9 or 13 and the free ends of the plates 20a, d locate at or near to the corners of the chamber 9 or 13.

In this way, the reinforcing member 20 provides the panel member 2 with substantially increased resistance to forces applied transverse to the vertical plane of the wall constructed from the panel members 2, i.e. in the direction of arrow C in Figure 2. In particular, the reinforcing members 20 strengthen the wall to withstand the wind loads to which the wall is subjected in use.

We have found that the wall may be reinforced sufficiently to withstand wind loads or other forces to which it can be subjected in the direction of arrow C by providing reinforcing members 20 in only some of the panel members 2. It will be understood however that we may provide reinforcing members 20 in all of the panel members 2 and/or we may employ reinforcing members 20 in each of the chambers 9 and 13 of a panel member 2 or any of the intermediate chambers 10, 11, 12.

Referring now to Figure 4, the support members 3, 4 are provided with a rebated section 21 on one side of the channel 3a, 4a at the lower end. The rebated section 21 allows a panel member 2 extending between the support members 3, 4 to be inserted into the channel 3a, 4a at the bottom and then slid upwards. In this way, a wall can be constructed by adding panel members 2 from the bottom until the desired height of the wall is achieved.

A lifting device (not shown) may be employed to raise the panel members 2 clear of the rebated section 21 and allow the next panel 2 to be inserted. When the desired height of the wall is achieved, the rebated section 21 can be closed with a detachable plate (not shown) to retain the bottom panel member 2 in position.

Constructing the wall from the bottom upwards in this way is easier than inserting panel members 2 in the channels 3a, 4a at the top of the support members 3, 4. Also, dismantling of the wall is facilitated and the panel members 2 can be removed with the roof in place.

Referring now to Figures 5 and 6 of the drawings, there is shown a modification to the wall system above-described to incorporate a glazing panel 30. For convenience, like reference numerals are used to indicate parts corresponding to the previous embodiment.

As shown, one of the panel members 2 is cut transversely through the chambers 10 and 12 to provide two glazing members 31, 32 of which one member 31 has a groove 8 for engagement with a tongue 7 of the adjacent panel member 2 and the other member 32 has a tongue 7 for engagement with a groove 8 of the adjacent panel member 2.

Each member 31, 32 also has a channel 33 along the edge opposite the tongue 7 or groove 8 to receive a glazing gasket 34 for locating and retaining the marginal edge of the glazing panel 30. Each member 31, 32 is further provided with a reinforcing member 20 in the chamber 9, 13 between the channel 33 and the tongue 7 or groove 8.

The reinforcing member 20 locally reinforces the upper and lower edges of the aperture for the glazing panel 30 to reduce the risk of the glazing panel 30 breaking under loads applied to the glazing panel 30 in the direction of arrow D.

The glazing panel 30 and glazing members 31, 32 may be extend the full width of the wall between the support members 3,4 as shown in Figure 5 and may be sized to replace one or more panel members 2. Alternatively, as shown in Figure 7, the glazing panel 30 may be of narrower width than the gap between the support members 3, 4.

In this arrangement, the glazing panel 30 is located between a pair of panel members 2a, 2b that are provided with glazing gaskets 34 to locate and retain the side edges of the glazing panel 30. The reinforcing members 20 extending through the glazing members 31,32 above and below the glazing panel 30 also extend through the panel members 2a, 2b to assist in locating and retaining these in place.

As will be appreciated, using the panel member 2 to form the glazing members 31, 32 reduces the number of components for manufacture and the glazing members 31, 32 are compatible with the panel members 2 for assembly. Other arrangements of glazing panels will be apparent to those skilled in the art.

It will be understood that the invention is not limited to the embodiments above-described and includes variations and modifications of any of the features described herein. Furthermore, while the invention has been described with particular reference to a wall system for constructing a building especially temporary buildings, it will be understood that the invention is not limited to such use, for example the wall system may be employed to construct a barrier such as a flood barrier, sound barrier or the like.